

Cost Analysis for
Household Hazardous Waste Collection

By

Andrew C. Files*
and
George K. Criner

*Associate Scientist, and Professor and Chair, respectively, Department of Resource Economics
and Policy, University of Maine, Orono, Maine

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Executive Summary

Household hazardous wastes (HHW) are items generated by households that are corrosive, toxic, ignitable, or reactive, and as such are hazardous to humans and/or the environment if disposed of improperly. Because of their point of generation, these wastes are exempt from hazardous waste regulation under state and federal hazardous waste management rules. As the number and volume of unwanted household hazardous products has grown, public officials across the country have responded by developing separate and safer management systems for these wastes. An increasing number of municipalities, service districts, counties, and states are implementing specialized collection programs. Nationwide, the number of HHW collection events is in the several thousand per year, the number of permanent collection facilities is over 500.

In 1999, Maine generated 1,696,006 tons of solid waste, of which an estimated one-quarter to one percent (0.25 to 1.0%) was Household Hazardous Waste. Using an average HHW percentage of 0.60% of all waste yields a generation of 10,176 tons or 20,352,000 pounds of HHW. In Maine, almost all HHW collections have been municipally funded and conducted as “one-day events”, with low participation, low volumes and costs ranging from relatively low to very high. Over the last two years, 24 regional or individual municipal events have been held, serving 70 communities.

To evaluate different HHW management systems using Maine demographics and geography, The Maine State Planning Office, in conjunction with the Maine Department of Environmental Protection, contracted with the University of Maine’s Department of Resource Economics and Policy to perform an analysis of the four primary most common HHW collection scenarios used across the country. The State undertook this work to help Maine’s communities reduce the presence of these hazardous materials in the municipal solid waste stream, and, in order to determine what type of collection system would be most economical and effective in terms of capturing HHW.

The factors involved in this analysis included cost, volumes collected, participation rates, municipal solid waste (MSW) toxicity reduction, as well as the role of public education and promotion. Specific elements of the analysis included individual cost components (i.e., administration, labor, materials and supplies, advertising/promotion, buildings, etc.), the types and percentages of waste collected, the expected participation rate for each scenario, and the amount of toxicity reduction of MSW. The four collection scenarios analyzed were: 1) at-door collection; 2) one-day collection events; 3) regional collection facilities; and 4) two “brick and mortar” facilities. In addition, the current state of universal waste collection in Maine was discussed. A summary of initial results are shown in the Executive Summary Table below.

In reviewing this table, it is important to keep in mind that the goal of the HHW collection program is to maximize both the citizen participation and HHW removal, while at the same time keeping costs at a reasonable level. Scenario 1 is an ‘at-door’ collection and removal service; Scenario 2 has a number of one-day collection events offered across the state; Scenario 3 has permanent storage facilities at a number of locations (seven in this analysis) that would also have one-day collections in ‘outlying’ areas; and Scenario 4 has two large permanent storage facilities in addition to one-day collections throughout the portion of the state the facility serves. Briefly, while Scenario 2 (the one-day collection event scenario) has the lowest cost, it also has the

lowest amount of HHW collected. On the other hand, Scenario 3 (the regional collection scenario) has the second-largest waste collected, but also has the second-highest cost. From a “dollars per pound” perspective, Scenario 4b (the brick and mortar with truck scenario) has the lowest cost, but it incurs a relatively large amount of capital costs.

In addition, from analyzing the waste stream of a number of HHW collection events from across Maine and the U.S. (see Appendix Table 5), paints comprise roughly 50% of the total waste collected. If some, or all, of this portion of the waste stream could be re-directed, such as through re-use opportunities, then the total cost of the program could be significantly reduced. Two approaches to re-directing paint from the simple to the hi tech are to create a “swap shop” and to create paint “blends”. In Keene, New Hampshire, the HHW facility has a room in which cans of paint are stored. Residents are able to access this room and to take any of the paint that they choose. The Metro District of the City of Portland, Oregon, as part of its permanent HHW management operations, has funded a paint blending facility that makes and offers a line of paint products. Also, private companies are remanufacturing and selling paint products collected and recycled through public programs.

Executive Summary Table: Statistics for Four HHW Collection Scenarios

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Introduction

Household hazardous wastes (HHW) are items generated by households that are corrosive, toxic, ignitable, or reactive, and as such are hazardous to humans and/or the environment if disposed of improperly. Specific items considered as HHW vary somewhat by regulatory agency. In Maine, the list of HHWs includes oil-based paints, flammable liquids (including resins), pressurized aerosols, liquid poisons, solid poisons, acids, pesticides, and household chemicals and cleaners. Until recently, most of these wastes were disposed of along with households' municipal solid waste. As a result of these unsound practices, an increasing number of municipalities and states are implementing specialized collection programs for these wastes.

Providing HHW collection programs is important for a number of reasons (Nightingale). First, it helps prevent chemical-exposure injuries to employees. Household hazardous wastes that are improperly disposed of have been known to cause serious injury to employees of solid waste disposal companies and waste-to-energy companies. Second, it protects water supplies by properly disposing of the HHW, thereby reducing the chance of it mixing with surface or groundwater. Third, it prevents damage to waste-handling equipment. Leaking corrosive chemicals have been known to damage waste-handling equipment especially at waste-to-energy facilities. Fourth, proper HHW collection and disposal reduce the incidence of accidents in the home from HHWs, which may result in lower insurance costs. And lastly, the collection and proper disposal of HHWs may result in the need for fewer special, Superfund-type cleanup of landfills.

Data collected from mature programs (Hennipin County, MN; Chittenden Solid Waste District, VT; and King County, WA) show a steady increase over time in the amounts of HHW collected and steady to slightly increasing participation rates. In all cases, there has been very positive citizen response to these HHW collection programs.

Most of Maine's HHW collections have been municipally funded and conducted as "one-day events", with low participation rates, low volumes and relatively high costs. The Maine State Planning Office and the Maine Department of Environmental Protection initiated this study to aid efforts in determining what type of collection system would be most economical and effective in terms of capturing HHW. It is hoped that the results of the study will be used to provide information to the Legislature as they consider what may be an appropriate State role in funding the establishment and operation of HHW collection efforts.

Based on this rationale for the specialized collection of HHWs, the Maine State Planning Office, in conjunction with the Maine Department of Environmental Protection, contracted with the University of Maine's Department of Resource Economics and Policy to perform an analysis of four primary HHW collection scenarios. The factors involved in this analysis included cost, volumes collected, participation rates, municipal solid waste (MSW) toxicity reduction, as well as the role of public education and promotion. Specific elements of the analysis included individual cost components (i.e., administration, labor, materials and supplies, education/promotion, buildings, etc.), the types and percentages of waste collected, the expected participation rate for each scenario, and the amount of toxicity reduction of MSW. The four scenarios analyzed were: 1) at-door collection; 2) one-day collection events; 3) regional collection facilities; and 4) two "brick and mortar" facilities. In addition, information is provided on the current level of

Universal Waste (UW) collection and recycling in Maine. A more in-depth description of the four primary scenarios, along with cost estimates for each, follows.

Scenario 1 (At-Door Collection)

With an at-door collection program, residents' HHW is collected at their homes. The process begins by residents calling a centralized facility that schedules a pick-up of HHW at their homes. When the call is made to the central facility, residents are provided instructions on how to label and package their HHWs and may be provided a container in which to put the wastes. The wastes are generally placed outside residents' homes (i.e., on a porch or near a garage) but not such that they are an obvious risk of vandalism. While this scenario is modeled as a state-run or municipal-run operation, there are contractors that perform this same service. Private/public partnerships in at the door collections are currently utilized by 9 counties in Pennsylvania and a dozen other public entities across the country. In those cases, the contractor often assists municipalities with educational materials and promoting the program. The contractor usually charges a fee that is based on previous programs performed by the contractor. The fee is normally a per household fee for a set number of households to be served. The primary benefits of this type of program are that the risk of spills occurring during transport by residents is eliminated, the ability to reach elderly and disabled residents is maximized, and the total cost of the program is known beforehand.

From an analysis of Maine's population, two basic programs were developed for modeling purposes – one urban and the other rural. The choice of regions, as opposed to communities, stems from the need to have a critical mass of residents to serve with a collection program. The data for the hypothetical urban region encompasses 94,888 households while the hypothetical rural region encompasses 58,551 households.

All cost details for the scenario are shown in Appendix Table 1 with summary results shown in Table 1 below. The annual cost estimates for this scenario as a whole were developed by estimating costs of the constituent parts of the scenario (including vehicle, labor, materials, advertising, and waste disposal). It is assumed that there will be seven regions, each with their own collection vehicle. The centralized facility for scheduling HHW pickups will be a state-wide facility with each region paying one-seventh of the cost of operation. The location of this facility has yet to be determined, but will likely be incorporated into an existing public works office. Participation rates used in this analysis are 4% of the households in the region, which is high in comparison to the less than 1% participation rate experienced in an actual "at-door" program in northeastern Pennsylvania. However, with proper publicity and awareness education, a 4% participation rate is believed to be attainable.

The annual vehicle costs are comprised of amortization payments, fuel costs, and maintenance costs. The vehicle amortization payments are analogous to monthly new car payments and are derived from a \$34,000 purchase price of a new modified cube van (Coffey; Davis), an 8% annual interest rate and a six-year life span. Based on this information the annual amortization cost of the vehicle is \$7,355.

Fuel costs are derived from an estimated fuel usage of 15 miles per gallon, an average fuel price of \$1.50 per gallon and an estimate of miles traveled in each type (urban and rural) of region. The miles traveled per year in each of the regions are calculated from the total road

miles in that region times the percent of total road miles per vehicle trip times the number of trips taken. For the urban region there are 3,739 miles traveled per year whereas for the rural region there are 12,495 miles traveled per year. Vehicle maintenance costs are derived from a \$.08 per mile estimated cost (Morin) times the annual miles traveled in each type of region. From these, the annual cost of the vehicle is \$8,028 for the urban region and \$9,604 for the rural region.

Table 1: Annual Costs of At-Door Collection

	Urban	Rural
Vehicle	\$ 8,028	\$ 9,604
Labor	\$ 39,330	\$ 39,330
Materials and Supplies	\$ 2,372	\$ 1,464
Advertising	\$ 23,722	\$ 14,638
Miscellaneous	\$ 2,000	\$ 2,000
Waste Disposal	\$ 208,754	\$ 128,812
Total Annual Costs per Region	\$ 284,206	\$ 195,848
	Annual Cost for Seven Urban Regions	Annual Cost for Seven Rural Regions
Total Annual Statewide Costs	\$ 1,989,439	\$ 1,370,933

Other costs associated with this scenario are labor, materials and supplies, advertising, and miscellaneous. The labor costs associated with this scenario are comprised of the salary and fringe benefits of one receptionist for the statewide call center and for two employees in each region.

The materials and supplies costs of this scenario are derived from a five dollar per household cost applied over only a portion (one-eighth) of the participating households. It was assumed that most residents would have the necessary boxes and other packing materials such that only one-eighth of the residents would need packing materials supplied to them. The advertising costs are derived from an estimated \$.25 per household cost, for distributing flyers and for newspaper inserts, times the number of households in each type of region. A miscellaneous cost of \$2,000 is applied to each region.

The disposal costs are based on an estimated 100 pounds of waste per household times the number of households in the region times the participation rate. The disposal cost per pound (\$.55/lb.) is based on bids received by a regional waste company in Maine.

The total cost for each of the two programs is then multiplied by seven, the number of regions in Maine, to estimate an annual statewide cost. While Maine is not comprised of strictly urban regions or strictly rural regions, using the urban and rural models establishes the expected range of costs for this scenario. If the state were entirely urban, the estimated annual statewide cost is \$1,989,439, and if the state were entirely rural, the estimated annual statewide cost is \$1,370,933. The dollars per pound costs are \$0.75 for the urban region and \$0.84 for the rural region. These costs were developed for a municipal-run operation and are comparable to the per-pound cost estimates provided by an at-door contractor.

Scenario 2 (One-Day Collection Events)

Another approach to the collection of HHW is the use of one-day collection events. Although no permanent structures are required, these collection events are usually held at municipal facilities, such as a transfer station or a municipal public works facility. With this in mind, the state was broken into 23 areas in order to model these one-day collection events. See the summary Table 2 below and Appendix Table 2 for the cost details of this scenario.

The collection events are generally organized by one or more municipalities jointly and are held periodically. In these types of events, the contractor sets up a receiving area at a pre-designated site and residents bring their HHW to the site. The event is usually scheduled for a weekend day and is organized by employees and volunteers of the participating municipalities. In some instances, residents are required to pre-register in order for employees to estimate beforehand the types and quantities being delivered. The benefits of this approach are that there are little fixed costs incurred (i.e., there are no dedicated permanent structures), it is possible to reach residents from a large number of municipalities at one time, and there are no HHWs stored at the site since the wastes are transported to a licensed facility at the end of the event. The primary drawbacks to this type of event are that residents transport their own waste, thus increasing the risk of spills and injuries, and the participation rate and amounts collected are directly affected by a list of variables including the weather on the day of the event, travel distance, level of promotion, length of wait, and location.

Table 2: Costs for One-Day Events

	Annual Cost per Area
Set-Up Labor	\$ 112
Collection Labor	\$ 894
Advertising	\$ 5,585
Administration	\$ 250
Miscellaneous	\$ 500
Waste Disposal	\$ 17,873
Total Annual Costs per Site	\$ 25,214
	Annual Cost for 23 Areas
Total Annual Statewide Costs	\$ 579,920

For cost estimation purposes, a representative site was developed from average data and then aggregated to create the state estimate. On average, each site will have 22,341 households from which to draw, and for each site the estimated participation rate is 2%. This participation rate results in the collection of waste from 447 households per one-day event, and is comparable to other one-day events held in Maine.

The labor costs for this scenario are comprised of set-up labor and collection labor where there are six employees working at an hourly rate of \$14 with a 33% fringe rate added on. These

employees work for one hour each in setting up and eight hours each in the collection phase. The advertising costs were estimated at a \$.25 per household rate and assume that advertising would consist of one-page flyers and newspaper inserts. Administration and miscellaneous costs were estimated at \$250 and \$500, respectively. The disposal cost is determined similar to Scenario 1. Each household is assumed to contribute 100 pounds of HHW with a cost of \$40 per household. As with Scenario 1, the per-household cost is based on bids received by a regional waste company in Maine. The estimated annual statewide cost of this scenario is \$579,920. This cost was determined by summing its individual components (including labor, advertising, and waste disposal costs).

Scenario 3 (Regional Collection Facilities)

A third approach to the collection of HHW is to locate and construct regional collection centers around the state. Summary Table 3 below and Appendix Table 3 provide a breakdown of costs for this scenario. A benefit of these centers is that they need not be modern “brick and mortar” structures requiring extensive capital outlays, but can be established with reduced costs at pre-existing waste facilities. In addition to serving residents at these regional sites, the facilities can also be used as a staging area for more numerous one-day events in other communities in the region.

The analysis for this scenario will estimate the cost of developing and providing seven facilities staggered throughout the state where approved storage lockers for the collected HHWs would be maintained. Each will act as a central collection facility for their area of the state, as well as a staging area for day collection events held in outlying communities. Each facility will be accessible to traffic, provide approved material storage lockers, be fenced, and have shelter to protect both the residents and the contractor from the elements. The expected days of operation are Saturday of each week throughout the year. One-day collection events in outlying areas will occur on one Saturday per month, for each of the six months from mid-April to mid-October. The benefits of such a scenario are that the benefits of a permanent facility with regular hours are combined with the benefits of periodic one-day events.

Costs for this scenario consist of the cost of the facility, operations costs, one-day event costs, administrative costs, advertising costs and miscellaneous costs. The annual cost of the facility is found by taking its new cost of \$225,000 and amortizing it at an 8% annual rate over the fifteen (15) year estimated life span of the facility. The new cost of the facility is comparable to similar facilities in other parts of New England.

The operation costs of the facility include labor costs, portable toilet costs, electricity costs, telephone costs, building maintenance costs, and disposal costs. The labor costs are based on two employees working eight hours per day for one day per week at an hourly rate of \$14. Included with this labor cost is a 33% fringe rate. The portable toilet costs are estimated at \$85 per month (AAA Portable Toilets). The electricity costs are estimated at \$100 per month. The telephone costs are estimated at \$75 per month. Annual building maintenance costs are estimated at 2% of new value and miscellaneous costs are estimated at \$2,000 annually. The disposal costs are calculated, similar to Scenario 2, by assuming 100 pounds of HHW per household times the \$40 per household rate times the participation rate of 3% for the facility without the one-day events.

The one-day event costs consist of set-up and collection labor costs and disposal costs. These costs are determined in the same manner as for Scenario 2. The labor costs are based on an hourly rate of \$14 with a 33% fringe added on and are applied to six employees for one hour of set-up and eight hours of collection. The disposal costs are based on a 2% participation rate for the entire six one-day events and on the estimated 100 pounds of HHW per household. As with the other scenarios, the \$40 per household disposal cost is based on bids received by a regional waste company in Maine.

Table 3: Costs for Seven Regional Facilities with One-Day Events Included

	Annual Cost per Region
Facility Construction	\$ 26,287
Labor (Facility)	\$ 15,492
Portable Toilet	\$ 1,020
Electricity	\$ 1,200
Telephone	\$ 900
Building Maintenance	\$ 4,500
Advertising	\$ 18,352
Administration	\$ 5,000
Miscellaneous	\$ 2,000
Waste Disposal (Facility)	\$ 88,089
Labor (Six One-day Events)	\$ 6,033
Waste Disposal (Six One-day Events)	\$ 58,726
Total Annual Costs per Region	\$ 227,598
	Annual Cost for Seven Regions
Total Annual Statewide Costs	\$ 1,593,184

It is assumed that there will be an annual administrative cost of \$5,000 and an annual miscellaneous cost of \$2,000. As with the other scenarios, the advertising cost is \$.25 per household.

Under this scenario, each region has an average of 73,407 households. It is estimated that 1,500 households will participate in the one-day events held throughout the region and 2,200 households will participate directly at the regional facility. This combines for a 5% participation rate. The estimated annual statewide cost for this scenario is \$1,593,184.

Scenario 4 (“Brick and Mortar” Facilities)

A fourth approach to the collection of HHW is to construct and operate two permanent, “brick and mortar” collection facilities. With regularly scheduled operating hours, these sites are available much more often than periodic one-day events, which can be impacted by weather.

The analysis of this scenario (Scenario 4a) will estimate the cost of providing two permanent HHW collection and storage facilities within the state. These sites will be regularly available to collect residents’ HHW as well as to assist in regional one-day collection events. A

contractor will provide the staffing, receiving and shipping of wastes collected at the facility. The expected days of operation are Saturdays throughout the year with one-day collection events in outlying areas occurring on each Saturday from mid-April through mid-October.

To diversify the analysis, a second “brick and mortar” scenario (Scenario 4b) was developed where the per household cost of disposing of the waste is reduced by 25%, but a truck is added, where the truck will be used in the one-day events held each Saturday. Transportation of waste from the one-day events to the “brick and mortar” facility is usually provided by the contractor with the cost included in the disposal fee. It is anticipated that with the State or a municipality providing the transportation the contractor will be willing to reduce the cost of HHW disposal. For this analysis, we assume the use of the State or municipal truck will reduce disposal costs from \$40 per household to \$30 per household. This “brick and mortar with truck” scenario is provided in order to mirror a program being run in Chittenden County, Vermont. See summary Tables 4a and 4b, below, and Appendix Tables 4a and 4b for the cost details of this scenario.

The participation rate of each of these scenarios is 4+%. Four percent of Maine’s households participate at the one-day collection events held throughout the state, with an estimated less than one-percent going directly to the “brick and mortar” facility. The annual facility construction costs are \$33,310 stemming from a new cost of \$550,000 being amortized over 30 years at an 8% annual interest rate.

Table 4a: Costs for Two Permanent Facilities with One-Day Events Included

	Annual Cost per Facility
Facility Construction	\$ 33,310
Labor (Facility)	\$ 15,492
Telephone	\$ 900
Electricity	\$ 1,200
Building Maintenance	\$ 16,500
Advertising	\$ 64,231
Administration	\$ 5,000
Miscellaneous	\$ 2,000
Waste Disposal (Facility)	\$ 88,089
Labor (26 One-Day Events)	\$ 26,142
Waste Disposal (26 One-Day Events)	\$ 411,081
Total Annual Costs per Facility	\$ 663,946
	Annual Cost for Two Facilities
Total Annual Statewide Costs	\$ 1,327,891

Scenario 4b: Costs for Two Permanent Facilities with One-Day Events (with Truck)

	Annual Cost per Facility
Facility Construction	\$ 33,310
Labor (Facility)	\$ 15,492
Telephone	\$ 900
Electricity	\$ 1,200
Building Maintenance	\$ 16,500
Advertising	\$ 64,231
Administration	\$ 5,000
Miscellaneous	\$ 2,000
Waste Disposal (Facility)	\$ 66,067
Vehicle	\$ 7,823
Labor (26 One-Day Events)	\$ 26,142
Waste Disposal (26 One-Day Events)	\$ 308,311
Total Annual Costs per Facility	\$ 546,976
	Annual Cost for Two Facilities
Total Annual Statewide Costs	\$ 1,093,952

The annual facility operation costs consist of labor costs, telephone costs, electricity costs, maintenance costs, and disposal costs. The labor costs are the same as for Scenario 3 where there are two employees working eight hours per day for one day per week at an hourly rate of \$14 with a 33% fringe rate. The telephone costs are estimated at \$75 per month while the electricity costs are estimated at \$100 per month. Maintenance costs are estimated at 3% of new value. Disposal costs are estimated at \$40 per household for Scenario 4a and \$30 per household for Scenario 4b (i.e., “with truck”).

The one-day event collection costs consist of set-up costs, collection costs, and disposal costs. The set-up and collection costs are the same as for Scenario 2 where there are six employees working at an hourly wage of \$14 with a 33% fringe rate added on. These employees work for one hour each in setting up and eight hours each in the collection phase. The disposal costs are the same as in the annual facility operation costs from above where the costs are \$40 per household for Scenario 4a and \$30 per household for Scenario 4b. The participation rate for each of these scenarios is estimated at 4% annually which is divided equally between the 26 one-day events.

As with the other scenarios, advertising costs were estimated at \$.25 per household. In addition, there were estimated administration and miscellaneous costs of \$5,000 and \$2,000, respectively. The estimated annual statewide cost for the “brick and mortar” scenario (Scenario 4a) is \$1,327,891 while the “brick and mortar with truck” (Scenario 4b) estimated annual statewide cost is \$1,093,952. The lower cost of Scenario 4b is due to the reduced per-household disposal cost.

Universal Waste in Maine

Universal Wastes (UW) are specific hazardous wastes generated by households as well as by business and governmental sources. Examples are televisions and computer monitors (cathode ray tube containing devices, know also as CRTs)), and fluorescent, mercury vapor and high-pressure sodium light bulbs, thermometers, thermostats, and other mercury containing devices.

In 2000, the Maine Legislature banned the future disposal into the municipal solid waste stream of mercury containing products with the passage of the Act to Reduce the Release of Mercury into the Environment from Consumer Products (public law chapter 779). The law bans the placement of mercury added products into the municipal solid waste stream regardless of the source of generation by January 1, 2005.

Presently in Maine, UW collection is based at the local level in municipal or regional programs, staffed by municipal employees, and serviced by private contractors for the removal, transportation, and recycling of these waste items. The State Planning Office has awarded grant funds to 24 public entities to aid in the construction of Storage Facilities for Universal Waste. These facilities are intended to serve 173 Maine communities. In addition, the Office has awarded prefabricated storage sheds to be delivered to an additional 26 public programs for the storage of Mercury containing Universal Waste only. These programs have the potential to serve an additional 50 communities. The result is that approximately 50% of the State's population will have access to a storage facility through their local programs.

As an additional aid to municipalities, the Office has entered into a statewide service agreement with a private electronics recycling facility for collection, transportation, and recycling services for CRT containing universal wastes; computers, peripherals, televisions, and other CRT containing devices. This is a non-exclusive agreement. Municipalities may voluntarily use this contract and thus avoid having to seek these services on their own. The Office is pursuing a similar agreement for the remaining types of Universal Wastes.

For a number of reasons, there are some communities that have chosen to hold collection events rather than opt for storage facilities. Those communities have decided that the storage option does not fit with their current scope of operations or that there is a lack of resources in time, space, and personnel. Similarly, other communities do not wish to bear the associated costs not covered by the grant or the longer-term commitment associated with a facility. In response, the Office has funded six grants to regional programs for these collection events, although not all the events have accepted the full range of universal wastes.

In terms of cost analyses, the primary difference between universal waste collection/recycling and household hazardous waste collection/disposal is in the cost of disposal and the way those costs are calculated. For HHW, collections have taken place for such a relatively long time that the disposal costs are now based on a per pound or per car basis for all wastes as a unit. For UW, however, the recycling costs are still applied on a per item basis. For example, different battery chemistries are charged at different rates per pound. In Maine, costs for all UW range from \$.08 per linear foot for fluorescent light bulbs to \$2.99 per pound for different types of batteries.

In terms of participation rates, there is little data available to provide estimates. However, from knowledge gained from the limited number of collection events that have taken place, there is no reason to assume that participation rates would be significantly different than those estimated for HHW collection programs. There is also little data to support volume estimates, as Maine programs at this point are in their initial start up phase.

Additional Information

For each scenario, it is assumed that 100 pounds of waste is collected per participating household. Also, the cost of HHW disposal is based on two bids provided to a waste facility in southern Maine by HHW disposal contractors. Lastly, the cost estimates generated above are based on municipalities (or the State) supplying all employees and facilities. Usually, the HHW disposal contractor provides some staff, which is covered in the disposal cost. As a result, the cost estimates presented above may be slightly larger than those incurred in actual practice.

In addition to the costs incurred by municipalities (or the State), transportation costs are incurred by households delivering their waste to the collection site. That is, households incur the cost of fuel and wear-and-tear on their vehicle in delivering their waste. Assuming the costs incurred by residents amount to 28 cents per mile, the annual statewide cost incurred by all participating households ranges from a low of \$60,000 in Scenario 2 to a high of \$150,000 in Scenario 3.

For Scenarios 3 and 4, where construction of a building is required, the cost estimates applied in the above analysis were based on costs of construction for similar buildings in other states. In Scenario 3, the construction costs include: the structure, electricity, approved, pre-fabricated HHW storage cabinets, processing areas, chemical-resistant floors, drive through bay (large enough for two cars side-by-side), asphalt paving, explosion-proof lighting, fencing, automatic fire suppression system and emergency back-up generator. For Scenario 4, the construction costs include all from Scenario 3, as well as: four-hour rated brick walls, concrete slab floor, bermed HHW storage area, and appropriate exhaust ventilation.

The facility construction costs in this study do not include extensive site development costs or permitting costs. In some cases, siting of a facility can be problematic due to variances required, or challenges made to the permit application.

Conclusions and Discussion

Upon review of the Executive Summary Table, no scenario appears to be clearly favorable over all others. While Scenario 2 (the one-day collection event scenario) has the lowest cost, it also has the next to lowest amount of HHW collected. On the other hand, Scenario 3 (the regional collection scenario) has the most waste collected, but also has the highest cost. From a “dollars per pound” perspective, Scenario 4b (the brick and mortar with truck scenario) has the lowest cost, but it has the next to lowest “disposal cost as a percent of total cost” which indicates that it has a substantial amount of operating and fixed costs involved. Such a broad conclusion supports the viewpoint that Maine may adopt a flexible and dynamic approach to HHW management so that municipalities and other public entities can tailor their own programs to meet their needs.

In addition, from analyzing the waste stream of a number of HHW collection events from across the state and U.S. (see Appendix Table 5), oil-based paints comprise roughly 50% of the total waste collected. If this portion of the stream could be re-directed, then the total disposal cost of the program could be significantly reduced. Since HHW disposal costs alone are \$0.50 per pound, disposing of paints as hazardous waste is an extremely expensive option. Waste paint can be recycled either through direct reuse of paint in original containers made available to the public in a “swap shop” or through a more complex process of waste paint blending for free distribution or sale to the public through either private, public, or a combination of operations.

In terms of paying for these HHW collection programs, there are a number of options available – State general funds, a portion of municipal property taxes, a portion of State and/or local sales taxes, fees paid by participating residents (pay-as-you-go fees), and specific product taxes. In terms of the specific product taxes, the state could identify the most common items in the HHW stream (for example oil-based paints) and place a small advance-disposal-fee tax on each container sold in the state.

References

AAA Portable Toilets, 2001. Personal communication with a representative at AAA Portable Toilets, Albion, Maine; 1-800-335-9345 on November 6, 2001.

Arienti, Mark and Eric Root, 2001. Personal visit with Mark Arienti and Eric Root, Environmental Manager and Director Materials Recycling, respectively, Regional Waste Systems, Portland, ME on October 9, 2001; (207)-773-6465.

Beaudoin, Robert, 2001. Personal visit with Robert Beaudoin, Superintendent, Solid Waste/Recycling, Department of Public Works, Lexington, MA on October 18, 2001; (781)-274-7298.

Coffey, Peter, 2001. Personal communication with Peter Coffey at Quirk Chevrolet, Bangor, Maine; 1-800-542-4389 on August 30, 2001.

Davis, Jim, 2001. Personal communication with Jim Davis at Whited Ford, Bangor, Maine; (207)-947-3673 on August 30, 2001.

Fisk, Al, 2001. Personal visit with Al Fisk, Recycling Foreman, Keene Recycling Center, Keene, NH on October 17, 2001; (603)-352-5739.

Fuller, Carol, 2001. Personal visit with Carol Fuller, Androscoggin Valley Council of Governments, Auburn, ME on October 9, 2001; (207)-783-9186.

Kirwan, Fred, 2001. Personal communication with Fred Kirwan, Division Manager, Curbside Recycling Program, City of Houston, TX; (713)-551-7307 on September 20, 2001.

Nightingale, David, 2000. "Expen\$ive But \$mart"; Waste Age, September, 2000.

Holliday, Jennifer, 2001. Personal visit with Jennifer Holliday, Environmental and Safety Compliance Manager, Chittenden Solid Waste District, Williston, VT on October 17, 2001; (802)-872-8100.

Hughes, Jerry, 2001. Personal communication with Jerry Hughes, Recycling Coordinator, Bangor Public Works, Bangor, ME on October 26, 2001; (207)-942-0220.

Maine Department of Environmental Protection, September 20, 2001. From the Maine DEP Web-site at <http://www.state.me.us/dep/rwm/UWsemregform.htm>

Morin, Gene, 2001. Personal communication with Gene Morin at KrisWay Transport, Portland, Maine; 1-800-544-5747 x150 on September 10, 2001.

Regional Waste Systems, 2000. "1999 Household Hazardous Waste Collection Program -- Annual Report"; Regional Waste Systems, Portland, Maine.

Ricker, Wayne, 2001. Personal visit with Wayne Ricker, Director of Solid Waste, Lisbon, ME on October 9, 2001; (207)-353-3009.

Appendix Table 1: Annual Costs of At-Door Collection

	Urban	Rural		Urban	Rural
Participation Rate	4%	4%			
Annual Vehicle Costs					
New Vehicle Cost	\$ 34,000	\$ 34,000			
Interest	8%	8%			
Life Span (in years)	6	6			
Annual Vehicle Payments	\$7,355	\$7,355			
Miles Travelled (per year)	3,739	12,495			
Miles per Gallon	15	15			
\$/Gallon	\$ 1.50	\$ 1.50			
Annual Fuel Costs	\$ 374	\$ 1,250			
\$/mile	\$ 0.08	\$ 0.08			
Miles Travelled	3,739	12,495			
Annual Vehicle Maintenance	\$ 299	\$ 1,000			
Annual Vehicle Costs			\$ 8,028	\$ 9,604	
Annual Labor Costs					
Receptionist, Annual Base	\$ 22,000	\$ 22,000			
% Full-Time*	7%	7%			
Fringe Rate	33%	33%			
Annual Wages and Fringe	\$ 2,090	\$ 2,090			
Pickup Person, Annual	\$ 28,000	\$ 28,000			
Number of Municipal Employees	2	2			
% Full-Time**	50%	50%			
Fringe Rate	33%	33%			
Annual Wages and Fringe	\$ 37,240	\$ 37,240			
Annual Labor Costs			\$ 39,330	\$ 39,330	
Annual Materials & Supplies					
\$/Household	\$ 5.00	\$ 5.00			
Number of Households	94,888	58,551			
% of Households***	0.50%	0.50%			
Annual Materials & Supplies			\$ 2,372	\$ 1,464	
Annual Advertising Costs					
\$/Household	\$ 0.25	\$ 0.25			
Number of Households	94,888	58,551			
% of Households****	100%	100%			
Annual Advertising Costs			\$ 23,722	\$ 14,638	
Annual Disposal Costs					
Lbs./Household	100	100			
Total Households	94,888	58,551			
Participation Rate	4%	4%			
\$/Lb*****	\$ 0.55	\$ 0.55			
Annual Disposal Costs			\$ 208,754	\$ 128,812	
Annual Miscellaneous Costs			\$ 2,000	\$ 2,000	
ANNUAL COSTS PER REGION			\$ 284,206	\$ 195,848	
Number of Regions	7	7			
ANNUAL COSTS (STATE)			\$ 1,989,439	\$ 1,370,933	
Miscellaneous Data					
Miles Travelled	3,739	12,495			
Region Road Miles	1,968	2,499			
Region Households	94,888	58,551			
Households/Trip	20	12			
# Trips	95	100			
% Miles/Trip	2%	5%			
* % Full-Time = Fraction of Full-Time Equivalent for that region. Assumes one full-time receptionist for entire state for six months of the year.					
** % Full-Time = Fraction of Full-Time Equivalents for that region. Assumes two full-time pick-up people per region for six months of the year.					
*** % of Households = The % of households receiving a recyclable container to store wastes.					
**** Lbs/Household = Average amount of waste collected from each household. This value is less than the 150 lbs/household collected in PA.					
***** \$/Lb = Estimate of what one vendor bid for disposal costs for RWS collections.					

Appendix Table 2: Annual Costs of One -Day Events

	Per Site	
<i>Annual Participation Rate</i>	2%	
<i>Collection Days per Year</i>	1	
Annual Set-Up Labor Costs		
Number of Municipal Employees	6	
Hourly Wage	\$ 14.00	
Hours per Employee	1	
Fringe Rate	33%	
<i>Annual Set-Up Labor Costs</i>		\$ 112
Annual Collection Labor Costs		
Number of Municipal Employees	6	
Hourly Wage	\$ 14.00	
Hours per Employee	8	
Fringe Rate	33%	
<i>Annual Collection Labor Costs</i>		\$ 894
Annual Advertising Costs		
\$/Household	\$ 0.25	
Number of Households	22,341	
<i>Annual Advertising Costs</i>		\$ 5,585
Annual Disposal Costs		
Lbs/Household	100	
Average Number of Households	22,341	
Participation Rate	2%	
Participating Households	447	
\$/Household	\$ 40.00	
<i>Annual Disposal Costs</i>		\$ 17,873
<i>Annual Administrative Costs</i>		\$ 250
<i>Annual Miscellaneous Costs</i>		\$ 500
ANNUAL COST PER SITE		\$ 25,214
Number of Sites	23	
TOTAL ANNUAL COST (STATE)		\$ 579,920

Appendix Table 3: Annual Costs of Seven Regional Facilities with One-Day Events Included

	Per Region	
Annual Participation Rate	5%	
Months of Operation	12	
Total Days of Operation per Year		
Saturdays	52	
Total Days of Operation per Year		52
Annual Facility Construction Costs		
New Cost	\$ 225,000	
Life Span	15	
Interest	8%	
Annual Facility Construction Costs		\$26,287
Annual Facility Operation Costs		
Number of Municipal Employees	2	
Hourly Wage	\$ 14.00	
Hours per Day	8	
Fringe Rate	33%	
Labor Costs	\$ 15,492	
Portable Toilet Monthly Rate	\$ 85	
Portable Toilet Costs	\$ 1,020	
Electricity Monthly Rate	\$ 100	
Electricity Costs	\$ 1,200	
Telephone Monthly Rate	\$ 75	
Telephone Costs	\$ 900	
Building Maintenance (2% of New Cost)	\$ 4,500	
Lb/Household	100	
Average Number of Households in Region	73,407	
Participation Rate	3%	
Participating Households	2,202	
\$/Household	\$ 40.00	
Disposal Costs	\$ 88,089	
Annual Facility Operation Costs		\$ 111,201
One-Day Event Collection Costs		
Set-Up Labor Costs (from Scenario 2)	\$ 112	
Collection Labor Costs (from Scenario 2)	\$ 894	
Lbs/Household	100	
Average Number of Households in Region	73,407	
Participating Households	245	
Participation Rate per Event	0.33%	
\$/Household	\$ 40.00	
Disposal Costs	\$ 9,788	
Costs per One-Day Event	\$ 10,793	
One-Day Events per Year	6	
One-Day Event Collection Costs		\$ 64,759
Annual Administrative Costs		\$ 5,000
Annual Advertising Costs		
\$/Household	\$ 0.25	
Average Number of Households in Region	73,407	
Annual Advertising Costs		\$ 18,352
Annual Miscellaneous Costs		\$ 2,000
ANNUAL REGION COST		\$227,598
Number of Regions	7	
TOTAL ANNUAL COST (STATE)		\$1,593,184

Appendix Table 4a: Annual Costs of Two Permanent Facilities with One-Day Events Included

	Per 1/2 of State	
<i>Months of Operation</i>	12	
Days of Operation per Year		
Saturdays	52	
Days of Operation per Year		52
Annual Facility Construction Costs		
New Facility Cost	\$ 550,000	
Life Span	30	
Interest	8%	
Annual Facility Construction Costs		\$33,310
Annual Facility Operation Costs		
Number of Municipal Employees	2	
Hourly Wage	\$ 14.00	
Hours per Day	8	
Fringe Rate	33%	
Labor Costs	\$ 15,492	
Telephone Monthly Rate	\$ 75	
Telephone Costs	\$ 900	
Electricity Monthly Rate	\$ 100	
Electricity Costs	\$ 1,200	
Maintenance Costs (3% of New)	\$ 16,500	
Lbs./Household	100	
Average Number of Households in Region	73,407	
Participation Rate	3%	
Participating Households	2,202	
Participating Households per Operating Day	42	
\$/Household	\$ 40.00	
Disposal Costs	\$ 88,089	
Annual Facility Operation Costs		\$ 122,181
One-Day Event Collection Costs		
Set-Up Costs (from Scenario 2)	\$ 112	
Collection Costs (from Scenario 2)	\$ 894	
Lbs./Household	100	
Average Number of Housholds in Region	256,926	
Participation Rate per Event (4% Annual)	0.15%	
Participating Households per Event	395	
\$/Household	\$ 40.00	
Disposal Costs (per Event)	\$ 15,811	
One-Day Events per Year	26	
One-Day Event Collection Costs		\$ 437,223
Annual Advertising Costs		
\$/Household	\$ 0.25	
Average Households	256,926	
Annual Advertising Costs		\$ 64,231
Annual Administrative Costs		\$ 5,000
Annual Miscellaneous Costs		\$ 2,000
ANNUAL COSTS (PER FACILITY)		\$663,946
Number of Facilities	2	
TOTAL ANNUAL COSTS (STATE)		\$1,327,891

**Appendix Table 4b: Annual Costs of Two Permanent Facilities with One-Day Events
Included (with Truck)**

	Per 1/2 of State	
Months of Operation	12	
Days of Operation per Year		
Saturdays	52	
Days of Operation per Year		52
Annual Facility Construction Costs		
New Facility Cost	\$ 550,000	
Life Span	30	
Interest	8%	
Annual Facility Construction Costs		\$33,310
Annual Facility Operation Costs		
Number of Municipal Employees	2	
Hourly Wage	\$ 14.00	
Hours per Day	8	
Fringe Rate	33%	
Labor Costs	\$ 15,492	
Telephone Monthly Rate	\$ 75	
Telephone Costs	\$ 900	
Electricity Monthly Rate	\$ 100	
Electricity Costs	\$ 1,200	
Maintenance Costs (3% of New)	\$ 16,500	
Lbs./Household	100	
Average Number of Households in Region	73,407	
Participation Rate	3%	
Participating Households	2,202	
Participating Households per Operating Day	42	
\$/Household	\$ 30.00	
Disposal Costs	\$ 66,067	
Annual Facility Operation Costs		\$ 100,158
One-Day Event Collection Costs		
Annual Vehicle Costs (2600 miles/yr)	\$ 7,823	
Set-Up Costs (from Scenario 2)	\$ 112	
Collection Costs (from Scenario 2)	\$ 894	
Lbs./Household	100	
Average Number of Housholds in Region	256,926	
Participation Rate per Event (4% Annual)	0.15%	
Participating Households per Event	395	
\$/Household	\$ 30.00	
Disposal Costs (per Event)	\$ 11,858	
One-Day Events per Year	26	
One-Day Event Collection Costs		\$ 342,276
Annual Advertising Costs		
\$/Household	\$ 0.25	
Average Households	256,926	
Annual Advertising Costs		\$ 64,231
Annual Administrative Costs		\$ 5,000
Annual Miscellaneous Costs		\$ 2,000
ANNUAL COSTS (PER FACILITY)		\$546,976
Number of Facilities	2	
TOTAL ANNUAL COSTS (STATE)		\$1,093,952

Appendix Table 5: Analysis of Various HHW Collection Programs

Item	NE Penn. 1999 (in lbs.)		NE Indiana 1999 (in tons)		King County 1998 (in tons)		RI 1999	
Oil-based paints	177985	56%	19.9	83%	236	37%	38%	44%
Flammable liquids (including resins)	128976	40%	2.2	9%	311.8	49%	26%	30%
Pressurized aerosols	5902	2%	0.357	1%	16.1	3%	6%	7%
Liquid poisons	2637	1%		0%		0%		0%
Solid poisons	3900	1%		0%		0%		0%
Acids	384	0%	0.672	3%	22.6	4%		0%
Pesticides		0%	0.848	4%	53.9	8%	10%	12%
Household chemicals and cleaners		0%		0%		0%	6%	7%
Total	319784	100%	23.977	100%	640.4	100%	86%	100%
Item	Chittenden FY2001 (in lbs.)		Bangor 10/01 (in lbs.)		RWS 1999 (in lbs.)		Chittenden FY 99 (in lbs.)	
Oil-based paints	55370	42%	1485	62%	250112	48%	58301	53%
Flammable liquids (including resins)	58938	45%	740	31%	165000	32%	44491	40%
Pressurized aerosols	7123	5%		0%	21018	4%	1394	1%
Liquid poisons		0%	7	0%		0%		0%
Solid poisons		0%		0%		0%	0	0%
Acids	2674	2%		0%	20600	4%	1814	2%
Pesticides	6728	5%	153	6%	57748	11%	4857	4%
Household chemicals and cleaners		0%		0%	5961	1%		0%
Total	130833	100%	2385	100%	520439	100%	110857	100%